



# AEC-NASA TECH BRIEF



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## Aggregation of Metallochlorophylls: Examination by Spectroscopy

Is coordination aggregation a unique property of magnesium-containing chlorophylls, or do other metallochlorophylls behave similarly? The aggregation properties of metallochlorophylls had not been studied in detail before recent presentation (1) of new information, derived from infrared and nuclear magnetic resonance (NMR) measurements, on the aggregation behavior of divalent nickel, copper, and zinc chlorophylls.

Metal ions play a decisive, but still little understood, role in the photosynthetic unit. Chlorophyll, the most important compound of photosynthesis, is a magnesium (II) complex of dihydroporphyrin (chlorin) liquid. Examination of chlorophyll derivatives in which magnesium is replaced by other metal ions (metallochlorophylls) is valuable in providing information about the contribution by the metal to the various properties and functions of chlorophyll. The state of aggregation of chlorophyll is a property requiring special attention.

The tendency to self-aggregation of divalent nickel, copper, and zinc methyl pheophorbides *a* and *b* was examined by infrared spectroscopy (1). Of these, only the zinc compounds show significant coordination aggregation. Measurements by NMR on zinc pheophytin *a* and zinc methyl pheophorbide *a* and *b* show that both coordination aggregation and aggregation occur in nonpolar solvents. However, NMR and infrared measurements indicate that under comparable conditions in nonpolar solvents the zinc chlorophylls are aggregated to a considerably lesser extent than are magnesium chlorophylls.

Visible and infrared spectra of nickel, copper, and zinc methyl pheophorbides *a* and *b* are reported (1)

and tentative band assignments are made. Considerations of absorption position and relative intensities suggest that the extent of metal-ligand interaction follows the order  $Ni > Cu > Zn > Mg$ . The materials used (1) were chromatographically pure, and their visible, ultraviolet, infrared, and NMR spectra are entirely compatible with their presumed molecular structures.

### Reference:

L. J. Boucher and J. J. Katz, *J. Amer. Chem. Soc.* **89**, 4703 (1967).

### Notes:

1. This information may be useful to horticulturists and canners of green vegetables.
2. Inquiries may be directed to:

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### Patent status:

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